CLAIMS

What is claimed is:

1. An integrated circuit manufacturing system comprising:

(a) a plurality of interrelated integrated circuit manufacturing tools capable of operating in parallel on a plurality of semiconductor wafers;

(b) a modular optical inspection system including

a plurality of modular inspection subsystems each configured to detect defects on a portion of a semiconductor wafer, and

a mechanism for moving at least one of the semiconductor wafer and the plurality of modular inspection subsystems with respect to one another; and

(c) a handling tool for moving the semiconductor wafers among the plurality of manufacturing tools and the inspection system.

Sub a2

2. The integrated circuit manufacturing system of claim 1, wherein the plurality of interrelated integrated circuit manufacturing tools comprise a cluster tool.

3. The integrated circuit manufacturing system of claim 1, wherein the modular optical inspection system is disposed proximate a cooling stage of the plurality of interrelated integrated circuit manufacturing tools.

Sub C2

4. The integrated circuit manufacturing system of claim 3, wherein the modular optical inspection system is disposed above a window of one of the integrated circuit manufacturing tools.

5. The integrated circuit manufacturing system of claim 1, wherein each of the modular inspection subsystems has a field of view spanning a fraction of the width of the semiconductor wafer.

Sub B2

6. In an integrated circuit manufacturing system including a plurality of interrelated integrated circuit manufacturing tools capable of operating in parallel on a plurality of semiconductor wafers, a method of inspecting a semiconductor comprising:

transferring the semiconductor wafer from one of the plurality of manufacturing tools to a modular optical inspection system including a plurality of modular inspection subsystems each configured to detect defects on a portion of the semiconductor wafer; and

moving at least one of the semiconductor wafer and the plurality of modular inspection subsystems with respect to one another such that each of the modular inspection subsystems inspects, in a single pass across the semiconductor wafer, an associated region of the semiconductor wafer.

7. The method of claim 6, wherein the plurality of interrelated integrated circuit manufacturing tools comprise a cluster tool.

8. The method claim 6, wherein the modular optical inspection system is disposed above a window of a cooling tool of the plurality of interrelated integrated circuit manufacturing tools.

9. A modular optical inspection system for inspecting a surface, the inspection system comprising:

a plurality of modular inspection subsystems each configured to detect defects on a portion of the surface; and

a mechanism for moving at least one of the surface and the plurality of modular inspection subsystems with respect to one another, wherein at least one of the plurality of modular inspection subsystems includes

(i) a two-dimensional sensor configured to receive light from the surface; and

(ii) a controller configured to control the relative speeds at which

data is read from the sensor and

the modular inspection subsystem and the surface are moved with respect to one another

such that the surface is imaged in a time-delay integration mode.

10. The modular optical inspection system of claim 9, wherein all of the plurality of modular inspection subsystems include separate sensors and separate controllers.

11. The modular optical inspection system of claim 9, wherein each of the modular inspection subsystems has a field of view spanning a fraction of the width of the surface.

12. The modular optical inspection system of claim 9, wherein the controller causes one row of pixel data to be read from the two-dimensional sensor

each time the at least one inspection subsystem moves by one pixel length with respect to the surface.

13. The modular optical inspection system of claim 9, wherein the two-dimensional sensor includes at least one of a CCD array.

14. The modular optical inspection system of claim 9, wherein at least one of the modular inspection subsystems comprises an illuminator capable of emitting light at a wavelength of no greater than about 500 nm.

15. The modular optical inspection system of claim 9, wherein at least one of the modular inspection subsystems comprises a coherent light source selected from the group consisting of diode lasers, Helium Neon lasers, Argon lasers, and frequency doubled YAG lasers.

16. The modular optical inspection system of claim 9, wherein at least one of said modular inspection subsystems contains an ellipsometer configured to measure the thickness of a layer on the surface.

17. A modular optical inspection system for inspecting a surface, the inspection system comprising:

a plurality of modular inspection subsystems each configured to detect defects on a portion of the surface;

a mechanism for moving at least one of the surface and the plurality of modular inspection subsystems with respect to one another; and

a master processor configured to process data delivered from at least some of the modular inspection subsystems,

wherein a first one of the plurality of modular inspection subsystems includes a local processor configured to process data collected by the first modular inspection subsystem.

18. The modular optical inspection system of claim 17, wherein all of the plurality of modular inspection subsystems include separate local processors.

19. The modular optical inspection system of claim 18, wherein the master processor is connected to each of the separate local processors.

20. The modular optical inspection system of claim 17, wherein each of the modular inspection subsystems has a field of view spanning a fraction of the width of the surface.

21. The modular optical inspection system of claim 17, wherein the local processor comprises a digital signal processor.

22. The modular optical inspection system of claim 17, wherein local processor implements an algorithm that distinguishes valid pattern scattering from defect scattering on the surface.

23. A Fourier filter system for use in a surface inspection system, the Fourier filter system comprising:

a translatable medium having transparent regions and opaque regions in fixed spatial relation to one another and defining multiple Fourier filters; and

a translation mechanism arranged to translate said translatable medium such that individual Fourier filters are presented for filtering light.

24. The Fourier filter system of claim 23, wherein spacing between the opaque regions varies substantially continuously over at least a segment of the translatable medium defining at least two Fourier filters.

25. The Fourier filter system of claim 23, wherein at least a segment of the translatable medium is divided into discrete Fourier filters.

26. The Fourier filter system of claim 23, wherein the translatable medium contains an etched metal.

27. The Fourier system of claim 23, wherein the translatable medium contains a transparent medium on which said opaque regions reside.

28. The Fourier filter system of claim 23, wherein the translatable medium includes parallel strips defining said opaque regions.

29. The Fourier filter system of claim 23, wherein the opaque regions comprise discrete spots.

30. The Fourier filter system of claim 23, wherein the translation mechanism comprises an actuator.

31. The Fourier filter system of claim 30, wherein the translation mechanism further comprises a roller which rotates under torque from the actuator, thereby translating said translatable medium.

32. The Fourier filter system of claim 30, wherein the translation mechanism has a single actuator only.

33. The Fourier filter system of claim 23, wherein the translation mechanism comprises a mechanism arranged to engage an actuator.

34. The Fourier filter system of claim 23, wherein the translatable medium comprises a continuous closed loop.

35. A modular optical inspection system for inspecting a surface having known valid feature patterns defining functional aspects of the surface, the inspection system comprising:

a plurality of modular inspection subsystems each configured to detect defects on a portion of the surface; and

a mechanism for moving at least one of the surface and the plurality of modular inspection subsystems with respect to one another, wherein at least one of the plurality of modular inspection subsystems includes

(i) a translatable medium having transparent regions and opaque regions in fixed spatial relation to one another and defining multiple Fourier filters; and

(ii) a translation mechanism arranged to translate said translatable medium such that individual Fourier filters are presented for filtering light.

36. The modular optical inspection system of claim 35, wherein spacing between the opaque regions varies substantially continuously over at least a segment of the translatable medium defining at least two Fourier filters.

37. The modular optical inspection system of claim 35, wherein at least a segment of the translatable medium is divided into discrete Fourier filters.

38. The modular optical inspection system of claim 35, wherein the translation mechanism comprises a single actuator.

39. In a surface inspection system having a Fourier filter sub-system defining multiple Fourier filters, a method of filtering an image of a surface, the method comprising:

(a) selecting a Fourier filter from the Fourier filter sub-system by

(i) illuminating a region of the surface containing valid features;

(ii) passing an opaque region or aperature through a Fourier image plane of the illuminated region of the surface and monitoring changes in light intensity passing through the filter;

(iii) determining a spatial frequency of a light intensity distribution in the Fourier image plane, the light intensity distribution being associated with valid periodic surface features; and

(iv) identifying a selected Fourier filter having a spatial frequency matching that of the light intensity distribution; and

(b) positioning said selected Fourier filter in the Fourier image plane.

40. The method of claim 39 further comprising:

in (a), determining a phase or position of the light intensity distribution; and

in (b), aligning the selected Fourier filter in the Fourier image plane to match the phase or position of the light intensity distribution.

41. The method of claim 39, wherein the opaque region is a strip of opaque material spanning substantially the length of the Fourier image plane.

42. The method of claim 39, wherein the Fourier filter sub-system comprises a translatable medium including transparent regions and opaque regions of fixed spatial relation to one another and defining the multiple Fourier filters.